1   1. A method practiced in a computer system of determining voxels in an object space that are

2   intersected by a ray,

3   the method comprising the steps of:

4   making projections of the ray on a plurality of planes in the object space;

5   determining cells in the planes that are intersected by the projections; and

6   using the intersected cells to determine the intersected voxels.

1   2. The method set forth in claim 1 wherein the step of determining cells in the planes includes the

2   step of:

3   for each projection determining a set of runs of cells that are intersected by the projection.

1   3. The method set forth in claim 2 wherein:

2   the runs may have an order greater than 1.

3

1   4. the method set forth in any one of claims 2 or 3 wherein:

2   the object space has an axis that is the major axis relative to the ray; and

3   in the step of using the intersected cells,

4   at the beginning of the next run of voxels,

5   if the first-order runs of cells that include the points in the projections

6   corresponding to the beginning of the next run of voxels end at the same major axis coordinate,

7   the first-order runs of cells together determine the next run of voxels through the ends of the first-

8   order runs; and

9   if the first order runs of cells that include the points in the projections

10   corresponding to the beginning of the next run of voxels do not end at the same major axis

11   coordinate, the shorter first order run of cells and the corresponding portion of the longer of the

12   first order runs of cells determine the next run of voxels,

13   whereby the voxels intersected by the ray are 26-connected.

1   5. The method set forth in claim 4 wherein:

2

2   in the step of using the intersected cells, an extra cell is added to the beginning of a first

3   order run of cells prior to using the first order run of cells to determine a run of voxels,

4   whereby the voxels intersected by the ray are 6-connected.

1   **6.** The method set forth in ~~any one of~~ claims 2 ~~or 3~~ wherein:

2   in the step of determining a set of runs, the set of runs for a given projection are

3   determined in parallel.

1   **7.** The method set forth in ~~any one of~~ claims 2 ~~or 3~~ wherein:

2   the step of using the intersected cells to determine the intersected voxels further includes

3   the step of determining whether the intersected voxels are edge-connected or corner-connected.

1   **8.** The method set forth in claim 7 wherein:

2   in the step of determining whether the intersected voxels are edge-connected or corner

3   connected,

4   if one of the first-order runs of cells has a corner connection at a point and the

5   other first order run of cells does not have a corner connection at the corresponding point, the

6   intersected voxels have an edge connection at the corresponding point.

1   **9.** The method set forth in claim 7 wherein:

2   in the step of determining whether the intersected voxels are edge-connected or corner

3   connected,

4   if both of the first-order runs of cells have corner connections at a corresponding

5   point, the intersected voxels have a corner connection at the corresponding point.

1   **10.** The method set forth in claim 1 wherein:

2   the object space has an axis that is the major axis relative to the ray; and

3   the plurality of planes is two planes which intersect along the major axis.

1   **11.** The method set forth in claim 10 wherein:

2   the two planes intersect at right angles.

1   **12.** A method practiced in a computer system of traversing a volume with a particular ray of a

2   plurality thereof, the volume being subdivided into first runs of voxels, certain of the voxels being

3   associated with data that affects rays, and a ray intersecting one or more of the first runs and being

4   defined as a set of second runs of voxels, and

5   the method comprising the steps of:

6   for a second run belonging to the particular ray, determining whether the second run

7   includes a voxel of a first run that affects rays; and

8   when the second run includes such a voxel, examining the associated data.

1   **13.** The method set forth in claim 12 wherein the first runs contain significant runs that include

2   the certain voxels; and

3   the step of determining whether the particular ray's second run includes a voxel of a first

4   run that affects rays includes determining whether the second run includes a voxel of a significant

5   run.

1   **14.** The method set forth in claim 12 wherein:

2   the volume has an axis that is the major axis for both the particular ray and the first runs of

3   voxels.

1   **15.** The method set forth in claim 14 wherein:

2   there are three sets of first runs, each set thereof having a different axis of the volume as its

3   major axis.

1   **16.** The method set forth in ~~any one of~~ claims 12 ~~through 15~~ wherein:

2   aggregate information is associated with partitions of the first runs, the aggregate

3   information associated with a partition indicating how one or more voxels in the partition affect

4   rays; and

5   in the step of determining whether second run includes a voxel of a first run that affects

6   rays, the aggregate information associated with a partition is used to determine whether the

7   partition contains a voxel that affects the particular ray.

4

1   **17.** The method set forth in claim 16 wherein:

2   a first run has associated therewith a plurality of sets of partitions, the partitions in each set

3   having a different length in voxels; and

4   the step of determining includes the step of selecting one of the sets of partitions in

5   accordance with the lengths of the second runs in the particular ray.

1   **18.** The method set forth in claim 13 wherein:

2   aggregate information is associated with the significant runs, the aggregate information

3   associated with the significant run indicating how one or more voxels in the partition affect rays;

4   and

5   the step of determining whether second run includes a voxel of a first run that affects rays

6   includes using the aggregate information associated with a significant run to determine whether

7   the significant run contains a voxel that affects the particular ray.